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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants: HIROI et al

Serial No.: 10/062,666

Filed: February 5, 2002

For: Pattern Inspection Method And System Therefor

Group: 2881

Examiner: J. Berman

APPEAL BRIEF

Mail Stop: Patent Appeals (Fee)
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

April 10, 2007

Sir:

This Appeal Brief is being submitted under 37 CFR 41.37 in connection with the appeal of the above-identified application, a Notice of Appeal having been filed on February 12, 2007.

REAL PARTY IN INTEREST

The real party in interest is Hitachi, Ltd. of Japan.

RELATED APPEALS AND INTERFERENCES

On information and belief, appellant is unaware of any prior and pending appeals, interferences or judicial proceedings which may be related to, directly

affect or be directly affected by or having a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1, 2, 4, 7 - 9 and 17 - 19 have been canceled with claims 3, 5, 6, 10 - 16 and 20 - 30 being rejected and on appeal.

STATUS OF AMENDMENTS

An Amendment After Final Rejection was filed on December 18, 2006 and a Supplemental Amendment After Final Rejection was filed on February 12, 2007. The Amendments filed December 18, 2006 and February 12, 2007 have been entered for purposes of appeal, and a copy of claims 3, 5, 6, 10 - 16 and 20 - 30, which are on appeal, appear in the Claim Appendix attached hereto.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention relates to a method for displaying a defect candidate image on a screen together with display on the same screen of defect candidate data which is displayed in a map format.

Independent claim 5, one of the independent claims on appeal, recites a defect candidate image displaying method as illustrated in Figs. 4 and 8 of the drawings, for example, wherein as shown in Fig. 4, a charged particle beam or light beam from a beam source 1 is irradiated onto a surface of a target substrate 5, which may in the form of a wafer 31, as illustrated in Fig. 7, and

having a pattern formed thereon, as described in the paragraph bridging pages 3 and 4 of the substitute specification. As described, a detector 8 detects secondary electrons 7 emitted from the target substrate 5 and, an A/D converter 9 converts a detected signal from analog to digital to form a digital image. Claim 5 recites the feature of producing an image of the substrate surface by detecting any of a reflected light, secondary electron, reflected electron, transmitted electron, or absorbed electron generated from the substrate as a result of irradiation and producing a digital image by subjecting the produced image signal to A/D conversion, which conversion is obtained by way of the A/D converter 9. After the conversion, as illustrated in Fig. 4 and described at page 4, lines 7 - 13 of the substitute specification, an image processing circuit 110 compares the digital image against a digital image that can be expected to be substantially identical, i.e., a reference image, and detects a difference in the images at a location as a pattern defect 11. Claim 5 recites the feature of comparing the digital image with a reference image and extracting a defect candidate, which is represented by the pattern defect 11. Further, claim 5 recites the features of outputting an actual image of the extracted defect candidate and data comprising the location of the defect candidate, via either a storage medium or a network, storing the outputted actual image of the extracted defect candidate and data comprising the location of the defect candidate, and displaying on a screen in a map format, the defect candidate location data outputted via either the storage medium or network. As described at page 4, lines 11 - 22, of the substitute specification, defect data storing means 201 operates to store defect data 200

comprising the defect location and image data of the pattern defect 11, and data output means 203 outputs the stored defect data 202 to either a network or a storage medium. An inputting means 205 is provided for inputting defect data 202 related to a plurality of wafers, which was outputted to data transferring means 204 by data outputting means 203, and defect data storing means 206 stores the inputted defect data. A defect map 207 operates to display defect location data of the wafer on a display screen, and applicants note that Fig. 8 shows in the map display portion 55 of the screen, display in a map format of the defect candidate location data which is outputted via the storage medium or network on the screen. In Fig. 4, there is illustrated an image display means 209 whereas Fig. 8 generally illustrates a display screen having a map display portion 55 and an adjacent image display portion 56, wherein the map display portion 55 corresponds to defect map 207 of Fig. 4, and the image display portion 56 corresponds to image displaying means 209 of Fig. 4. As recited in claim 5, the method includes displaying on the screen a selected one of the stored actual images of the extracted defect candidates which is designated on the screen among the extracted defect candidate data displayed in the map format on the screen so that the selected one of the stored actual images is displayed together with the map format on the screen. That is, as shown in Fig. 8, defect candidate location is represented in the map display portion 55 by circles and rectangles representing location of a defect on the wafer map, and as described in the paragraph bridging pages 13 and 14 of the substitute specification, an image of a defect specified from among the defects displayed on the map display portion

55 is displayed on image display portion 56. As described, specifying a defect for displaying of this image is effected by operating a mouse operation command button 142, selecting a selection mode 145 from among a selection mode 145 and a zooming mode 146 and moving the current location symbol or cursor 59 with the mouse to a desired position over a candidate data location, a location of the defect to be viewed so that the image of the defect selected is displayed on the image display portion 56, of the screen simultaneously with the defect candidate location data displayed on the image display portion 56 of the screen. Although not illustrated in Fig. 8, an actual image of the defect at the location of the symbol 59 at a defect location displayed on the map display portion 55 is then displayed in the image display portion 56, so that the selected one of the stored actual images corresponding to the image for the location at which the symbol or cursor 59 on the map format display 56 is displayed together with the display of map format on the screen simultaneously.

Independent Claim 6, another independent claim on appeal recites a defect candidate image displaying method comprising the steps of detecting a defect candidate of a pattern by using a inspecting means, which as illustrated in Figs. 1 and 7 of the drawings is obtained by the electron optical system 34 which is utilized for applying an electron beam to the substrate or wafer 31 and detecting a secondary electron 7 emitted therefrom by way of the detector 8 wherein after conversion by the A/D converter 9, the image processing circuit 110 outputs an actual image of the detected defect candidate and data including location information of the defect candidate as described at pages 11 and 12 of

the specification. The outputted defect candidate actual image and date including location information of the defect candidate is stored in a memory, as recited in claim 6 as represented by the data storage means 201 and 202. As shown in Fig. 8, stored defect candidate data is displayed on a map portion 55 of a screen in a map format, and as described, by locating a current location symbol 59, as illustrated in Fig. 8 over one of the defect candidates, and continuing the operations as described, an actual image of the stored defect candidate as selected which is designated on the screen among the defect candidate data displayed in the map form and the screen is displayed together with the map format on the image display portion 56 of the screen of the display.

Independent Claim 16, another of the independent claims on appeal, also recites the feature of a defect candidate image displaying method including the steps of imaging a substrate on which a pattern is formed as obtained by the electron optical system 64 as shown in Fig. 7 and processing an image obtained by the imaging to detect a defect candidate of the pattern as obtained by the image processing circuit 110. Claim 16 recites the feature of outputting an actual image of the detected defect candidate and data including location information of the defect candidate while carrying out the step of imaging the substrate and the step of detecting a defect candidate of the pattern as described at pages 11 and 12 of the specification. Claim 16 further recites storing the outputted actual image of the detected defect candidate and data including location information of the defect candidate in a memory, as represented by the defect data storage means 201, and as described in

connection with Fig. 8 simultaneously displaying, on a screen, having map display portion 55 and image display portion 56, the actual defect candidate image, which is selected by locating and clicking on the current location symbol 59 on a defect candidate displayed in map form in the map display portion 55 while the actual image is displayed in image display portion 56.

Dependent Claims

With respect to the dependent claims, dependent claims 3, 25 and 26 depend from independent claim 5 wherein claim 3 which is an original claim of the application, but has been amended to depend from claim 5 recites the feature that the information outputted at the outputting step includes data enabling the classification of the defect. Applicants note that Fig. 5 shows the frequency of different defects and may be considered to illustrate classification, for example. Claims 25 and 26 recite the feature that the map format is displayed at one portion of the screen, as represented by the map display portion 55 in Fig. 8, and that the displayed actual image of the defect candidate is simultaneously displayed at another portion of the screen as represented by the image display portion 56, although Fig. 8 does not illustrate the actual image being displayed. Claim 26 recites the feature that the one portion and the another portion of the screen are adjacent portions of the screen, as illustrated in Fig. 8.

As to the dependent claims which depend from independent claim 6, claims 10 - 15 represent original claims amended to recite the feature of the defect candidate image displaying method and reciting further features of the

present invention. Thus, claim 10, an original claim, representing part of the original application and disclosure, as filed, recites the step of changing threshold value data on the screen, when detecting a defect candidate of the pattern using the inspecting means and claim 11 recites the feature that the defect candidate location data display in map format is updated and displayed in accordance with the change threshold value data. Claim 12 recites the step that the defect candidates are classified using the images of defect candidates outputted via either the storage means or network and data comprising the locations of these defect candidates and location data of these classified defect candidates is identified by classification and displayed in map format on the screen. Claim 13 is similar to claim 12 while reciting the feature that the location data of the designated defect candidate from among these classified defect candidates is displayed in map format on the screen. Claim 14 depends from claim 13 and recites the feature that location data of defect candidates of a plurality of classifications designated from among the classified defect candidates is identified by the classifications and displayed in map format on the screen and claim 15 depends from claim 13 and recites further comprising the steps of processing the inputted actual image of the defect candidate and data comprising location of this defect candidate by the processing means, and therefore, outputting via the network. Dependent claims 27 and 28 recite features as recited in claims 25 and 26 concerning the feature that the map format and the actual displayed image of the defect candidate are simultaneously displayed at positions adjacent one another on the screen, as

represented on the screen as represented by the adjacent map display portion 55 and image display portion 56, as illustrated in Fig. 8.

With regard to the dependent claims, which depend from independent claim 16, such dependent claims include claims 20 - 24, 29 and 30 wherein claims 20 - 24 represent original claims of the application as filed and represent part of the original disclosure with such claims being amended to recite the defect candidate image displaying method. Claim 20 recites the step of changing threshold value data for detecting a defect candidate of the pattern on the screen with dependent claim 21 which depends from claim 20 reciting the feature that the location of the defect candidate displayed in map format is updated and displayed in accordance with the change threshold value data. Claim 22 recites the feature that in the step of displaying on the screen, the defect candidates are classified using the actual images of defect candidates and data including location information of the defect candidate outputted via either the storage medium and network and identically classified defect candidates are displayed in map format on the screen. Claim 23 recites the feature that in the step of displaying on the screen, the defect candidates are classified using the actual images of defect candidates and data including location information of the defect candidates outputted via either the storage medium or network, and defect candidate location data designated from among the classified defect candidates is displayed in map format on the screen. Claim 24 recites the feature that plural classes of defect candidates from among the classified defect candidates are displayed on the screen discriminately from

each other in the map format. Claims 29 and 30 correspond to claims 25 and 26 and 27, 28, as discussed above, and recite the feature that the map format is displayed at one portion of the screen and the displayed actual image is simultaneously displayed at another portion of the screen which portions are adjacent one another as illustrated in Fig. 8.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 3, 5, 6, 12 - 16 and 25 - 30 stand rejected under 35 USC 103(a) as being unpatentable over Mizuno in view of Hardikar et al.

Claims 10, 11 and 20 - 24 stand rejected under 35 USC 103(a) as being unpatentable over Mizuno in view of Hardikar et al and Gallarda.

ARGUMENTS

Appellants submit that each of independent claims 5, 6 and 16 recite a defect candidate image displaying method, wherein actual images of defect candidates are obtained in addition to location data for such images and the defect candidate location data is displayed on a screen in a map format and additionally, a selected one of the actual images of the stored defect candidate which is designated on the screen among the defect candidate data displayed in the map format on the screen is displayed together or simultaneously with the display of the map format on the screen. Irrespective of the contentions by the Examiner, such features are not disclosed or taught in the cited art.

Turning to Mizuno, Fig. 6A of Mizuno discloses displaying on a screen in a

map format, defect candidate location data as represented by the specified points or dots shown in the chips of the wafer. Moreover, Mizuno in Figs. \ 2A - 2D may be considered to disclose detection of defects, and Figs. 2A - 2D may be considered to represent actual images of such defects.

Appellants note that Mizuno at column 6, lines 32 - 44 provide:

> The means used for classifying the types and sizes of the defects is, for example, of a hardware configuration such as shown in portion A of Fig. 1. In other words, the elements shown in portion A carry out the above-described steps (12) and (13) of Fig. 3 (detailed in Figs. 4 and 5). (emphasis added).

In accordance with the disclosure of Mizuno, defects are classified in accordance with steps (12) and (13) of Fig. 3, wherein an SEM image for inspection is formed, as indicated in step (10) and a comparison is effected between the SEM image for inspection and a reference image, so as to detect a differing portion, as indicated in step (11), as also shown in Fig. 4. Based upon this detected differing portion or defect, a classification is effected, which classification is represented by the symbol as shown in the right-hand portion of Fig. 6B of Mizuno, wherein as shown in the left-hand portion of Fig. 6B, the symbol is super imposed on the defect location, as a symbol representing the type of defect. Applicants submit that it is readily apparent that the symbols  ; the symbols  ; or other symbols utilized while being representative of a type of defect, are not disclosed or taught to be an "actual image of the extracted defect candidate", such that Mizuno, does not disclose or teach, irrespective of the Examiner's contentions, the recited features of

independent claims 5, 6 and 16, that in addition to displaying in a screen in a map format, location data of defect candidates, a selected one of the actual image of the stored defect candidate which is designated on the screen among the defect candidate displayed in the map format on the screen, is displayed together or simultaneously on the screen. Appellants submit that Mizuno provides no disclosure or teaching of this structural arrangement as recited in the independent and dependent claims of this application.

With respect to Hardikar et al, appellants submit that Hardikar et al does not overcome the deficiencies of Mizuno et al, as pointed out above. Appellants submit that Fig. 6C of Hardikar et al discloses display of a wafer map 681 together with display of other information, such as defect classification, by color coding in accordance with the drop down list box 682, for example. Thus, Hardikar et al is substantially similar to Mizuno in that the display of other information, corresponds somewhat to the information as displayed in Fig. 6B of Mizuno. Although Figs. 6D and 6E of Hardikar et al show different types of information which can be displayed, there is no disclosure or teaching in Hardikar et al of displaying an actual image of a defect which is designated on the map format display, together with the map format display, as recited in the claims of this application.

As is apparent, Hardikar et al provides no disclosure or teaching that, in addition to displaying defect candidate data in a map format, there is additionally displayed on the same screen, a selected one of the actual image of a stored defect which is designated on the screen among the defect candidate data

displayed in the map format on the screen, with the attendant advantages as described in the specification of this application. Thus, appellants submit that Hardikar et al, like Mizuno, fail to provide any disclosure or teaching of displaying an actual image of the detected defect together with the location data of the defect candidates which are displayed in a map format on the same screen.

Appellants note that the Examiner has apparently recognized that neither Mizuno nor Hardikar et al disclose or teach the recited features of the independent claims of this application and the Examiner indicates that "it would have been obvious to a person having ordinary skill in the art to arrange these displays in any format that such a person found to be convenient including on the same screen." (emphasis added). Reference is made to the requirements to support a rejection under 35 USC 103 as set forth in the decision of In re Fine, 5 USPQ 2d 1596 (Fed. Cir. 1988), wherein the court pointed out that the PTO has the burden under '103 to establish a prima facie case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. As further noted by the court, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

Appellants submit that the Examiner has engaged in a hindsight reconstruction attempt utilizing what applicant has taught against the teacher and such is not proper in the sense of 35 USC 103.

With respect to the addition of Gallarda, whether or not Gallarda may be considered to disclose utilizing different thresholds for defect detection, appellants submit that Gallarda, like Mizuno and Hardikar et al, provides no disclosure or teaching of displaying a screen defect candidate location data in a map format and, additionally displaying on the screen, a selected one of an actual image of a defect candidate which is designated on the screen among the defect candidate data displayed in the map format on the screen, so that the map format and the actual image of the designated defect candidate are displayed together, i.e., simultaneously on the same screen, as recited in independent claims 5, 6 and 16 of this application. Thus, appellants submit that the combination of Mizuno, Hardikar et al and Gallarda taken alone or in any combination thereof, fail to provide the recited features of the independent claims 5, 6 and 16 and therewith the dependent claims of this application.

With respect the dependent claims, the dependent claims recite further features concerning the manner of detection and classification and display of the recited information on the screen. While the Examiner refers to various features being found in the cited art, as pointed out above, the dependent claims further define features of the independent claims, which features of the independent claims are not disclosed or taught by the cited art taken individually or in any combination thereof. Whether or not the Examiner could modify any of the cited

art to provide a defect candidate image display, as recited in the claims of this application, appellants submit there is no disclosure or teaching of the recited features in the art applied in rejecting claims of this application.

CONCLUSION

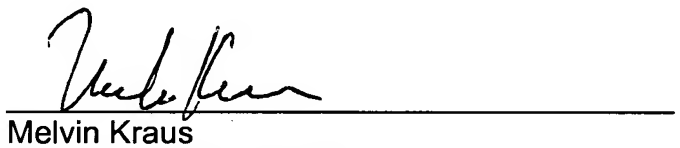
For the foregoing reasons, appellants request that the Examiner's rejections be reversed.

The Appeal Brief fee is submitted herewith.

Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of Antonelli, Terry, Stout & Kraus, Deposit Account No. 01-2135 (Case: 501.41125X00), and please credit any excess fees to said deposit account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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CLAIM APPENDIX

3. The defect candidate image displaying method according to Claim 5, wherein said information outputted at the outputting step includes data enabling the classification of the defect.

5. A defect candidate image displaying method, comprising the steps of:

irradiating either a charged particle or a light on a surface of a substrate on which a pattern is formed;

producing an image of said substrate surface by detecting any of a reflected light, secondary electron, reflected electron, transmitted electron, or absorbed electron generated from said substrate as a result of the irradiation;

producing a digital image by subjecting the produced image signal to A/D conversion;

comparing the digital image with a reference image and extracting a defect candidate;

outputting an actual image of the extracted defect candidate and data comprising the location of the defect candidate, via either a storage medium or a network;

storing said outputted actual image of the extracted defect candidate and data comprising the location of the defect candidate;

displaying on a screen in a map format the defect candidate location data outputted via either said storage medium or network; and

displaying on said screen a selected one of the stored actual images of the extracted defect candidates which is designated on said screen among the

extracted defect candidate data displayed in said map format on said screen so that the selected one of the stored actual images is displayed together with said map format on said screen.

6. A defect candidate image displaying method, comprising the steps of:

detecting a defect candidate of a pattern by using an inspecting means;

outputting an actual image of the detected defect candidate and data including location information of the defect candidate;

storing said outputted defect candidate actual image and data including location information of the defect candidate in a memory;

displaying the stored defect candidate data on a screen in map format; and

displaying on said screen a selected one of the actual images of the stored defect candidates stored in said memory which is designated on said screen among the defect candidate data displayed in said map format on said screen so that the selected one of the actual images is displayed together with said map format on said screen.

10. The defect candidate image displaying method according to Claim 6, further comprising the step of changing threshold value data on said screen, when detecting a defect candidate of said pattern using said inspecting means.

11. The defect candidate image displaying method according to Claim 10, wherein defect candidate location data displayed in map format is updated

and displayed in accordance with said changed threshold value data.

12. The defect candidate image displaying method according to Claim 6, wherein, in said step for displaying on said screen, said defect candidates are classified using the actual images of defect candidates outputted via either said storage medium or network and data comprising the locations of the defect candidates, and location data of the classified defect candidates is identified by classification and displayed in map format on said screen.

13. The defect candidate image displaying method according to Claim 6, wherein, in said step for displaying on said screen, said defect candidates are classified using the actual images of defect candidates outputted via either said storage medium or network and data comprising the locations of the defect candidates, and location data of the designated defect candidate from among these classified defect candidates is displayed in map format on said screen.

14. The defect candidate image displaying method according to Claim 13, wherein location data of defect candidates of a plurality of classifications designated from among said classified defect candidates is identified by said classifications and displayed in map format on said screen.

15. The defect candidate image displaying method according to Claim 13, further comprising the steps of processing said inputted actual image of said defect candidate and data comprising the location of this defect candidate by said processing means, and thereafter outputting via said network.

16. A defect candidate image displaying method, comprising the steps of:

imaging a substrate on which a pattern is formed;

processing an image obtained by said imaging to detect a defect candidate of said pattern;

outputting an actual image of said detected defect candidate and data including location information of the defect candidate via a network while carrying out the step of imaging said substrate and the step of detecting a defect candidate of said pattern;

storing said outputted actual image of said detected defect candidate and data including location information of the defect candidate in a memory; and

simultaneously displaying, on a screen, said actual defect candidate image and data including the location information of the defect candidate stored in said memory;

wherein, in the step of simultaneously displaying, said defect candidate data of location information is displayed in a map format on said screen and said actual defect candidate image which is simultaneously displayed on said screen is a selected one of the stored actual images of the detected defect candidates stored in said memory, which is designated on said screen among the defect candidate data displayed in said map format on said screen.

20. The defect candidate image displaying method according to Claim 16, further comprising the step of changing threshold value data for detecting a defect candidate of said pattern on said screen.

21. The defect candidate image displaying method according to Claim 20, wherein the location of the defect candidate displayed in map format is updated and displayed in accordance with said changed threshold value data.

22. The defect candidate image displaying method according to Claim 16, wherein, in the step of displaying on said screen, said defect candidates are classified using the actual images of defect candidates and data including location information of the defect candidates outputted via either said storage medium or network, and identically classified defect candidates are displayed in map format on said screen.

23. The defect candidate image displaying method according to Claim 16, wherein, in the step of displaying on said screen, said defect candidates are classified using the actual images of defect candidates and data including location information of the defect candidates outputted via either said storage medium or network, and defect candidate location data designated from among the classified defect candidates is displayed in map format on said screen.

24. The defect candidate image displaying method according to Claim 23, wherein plural classes of defect candidates designated from among said classified defect candidates are displayed on said screen discriminately from each other in the map format.

25. The defect candidate image displaying method according to claim

5, wherein said map format is displayed at one portion of said screen and said displayed actual image of the defect candidate is simultaneously displayed at another portion of said screen.

26. The defect candidate image displaying method according to claim 25, wherein the one portion and the another portion of said screen are adjacent portions of said screen.

27. The defect candidate image displaying method according to claim 6, wherein said map format and said actual displayed image of the defect candidate are simultaneously displayed at positions adjacent one another on said screen.

28. The defect candidate image displaying method according to claim 27, wherein the one portion and the another portion of said screen are adjacent portions of said screen.

29. The defect candidate image displaying method according to claim 16, wherein said map format and said actual displayed image of the defect candidate are simultaneously displayed at positions adjacent one another on said screen.

30. The defect candidate image displaying method according to claim 29, wherein the one portion and the another portion of said screen are adjacent portions of said screen.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None